Optimizing Biosolids Processing, Energy Reuse and Sidestream Treatment

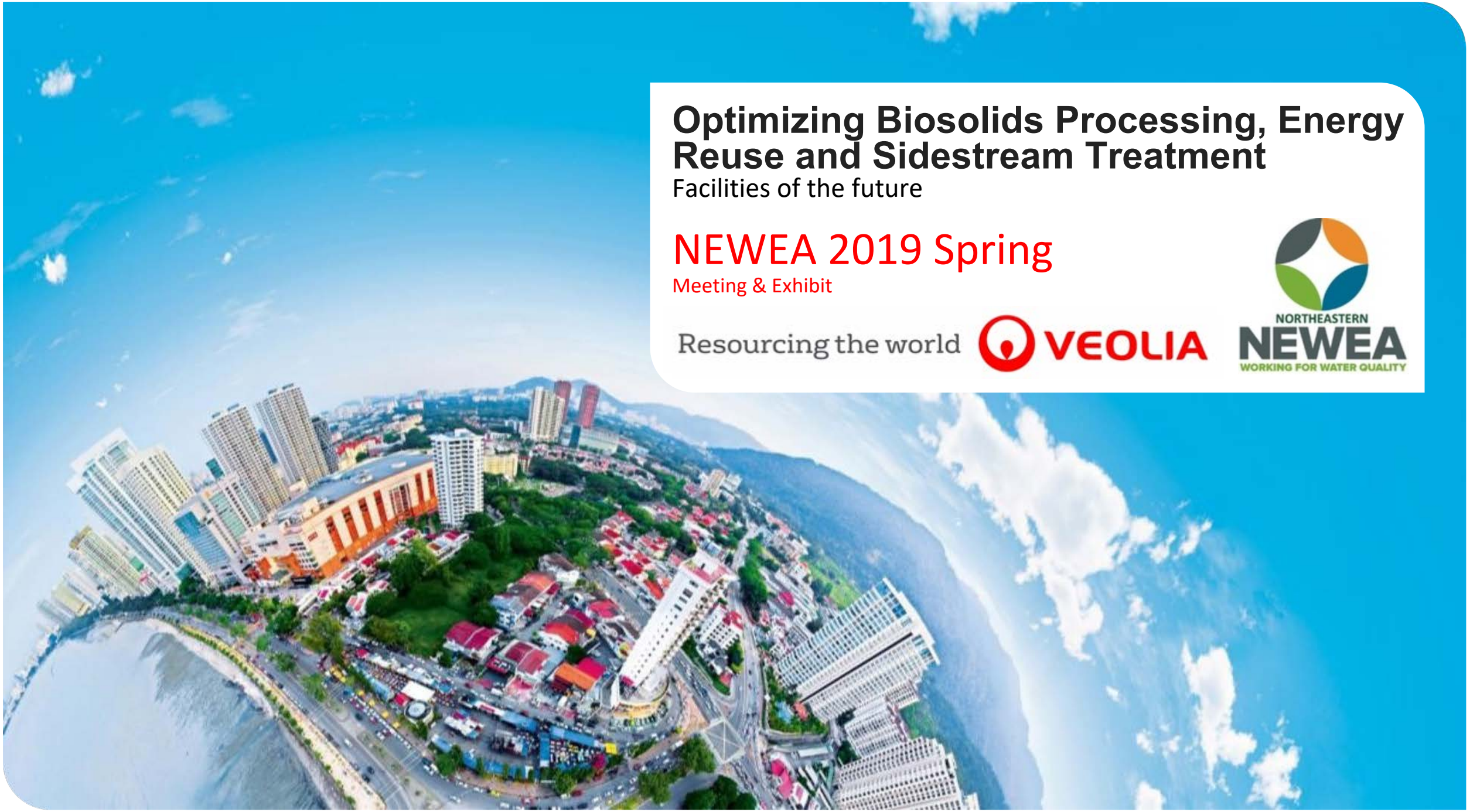
Facilities of the future

NEWEA 2019 Spring

Meeting & Exhibit

Resourcing the world VEOLIA

NORTHEASTERN NEWEA WORKING FOR WATER QUALITY



Overview

- Introduction
- Challenges
- Solutions
- Case Study
- Summary

Acknowledgement

Brad

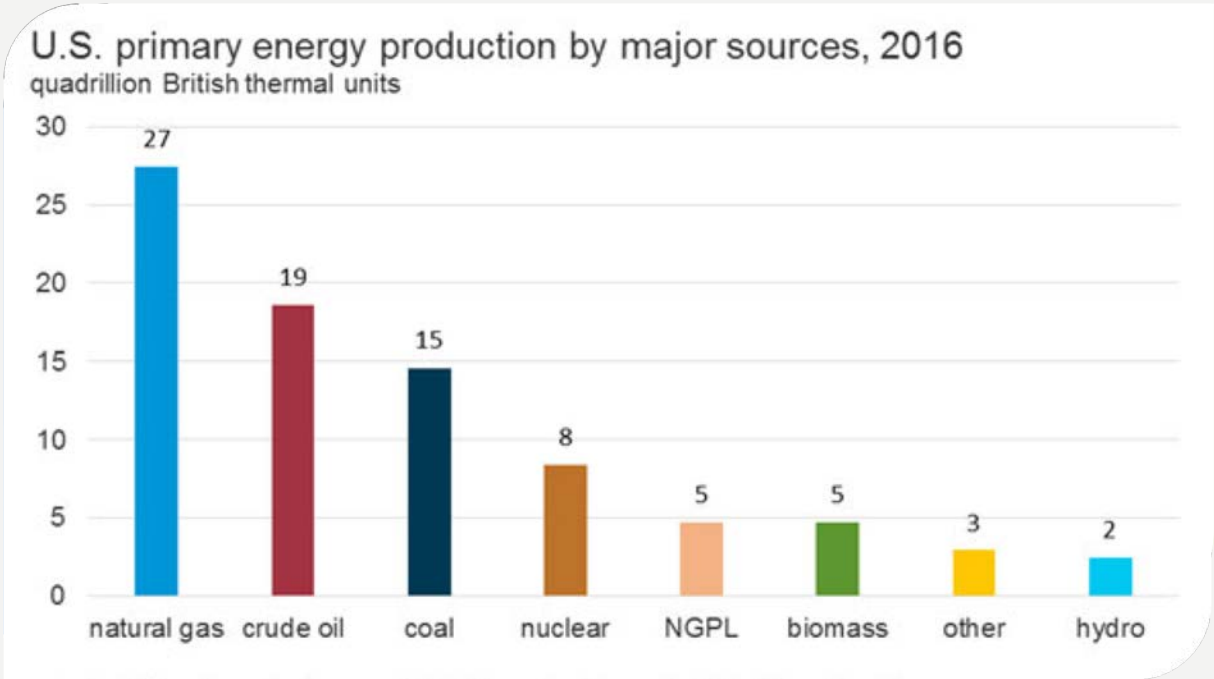
Meg

Facts to consider

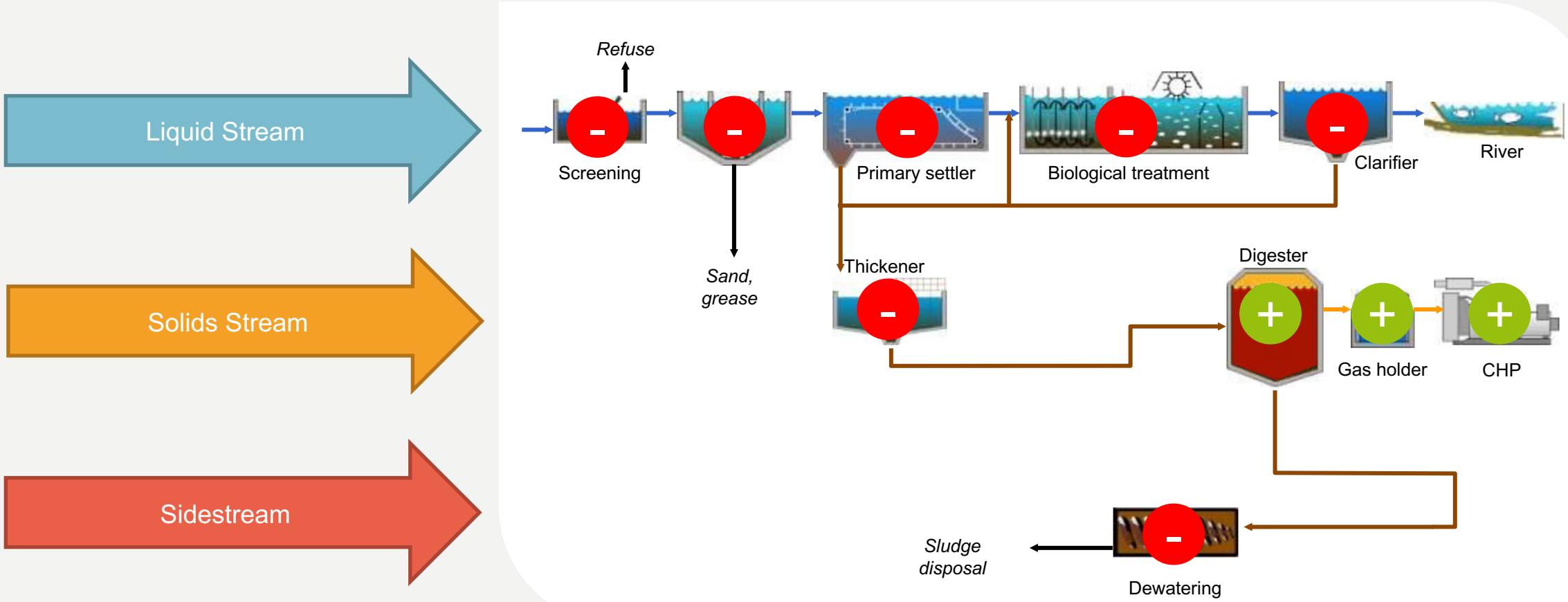
- 14,748 WTF in US (ASCE)
- ~ 56 million new users in next 20 years

- Landfills banning organic

- WTF Consumes 1 - 4 % of all electricity in the US
- < 10% electricity from renewable sources

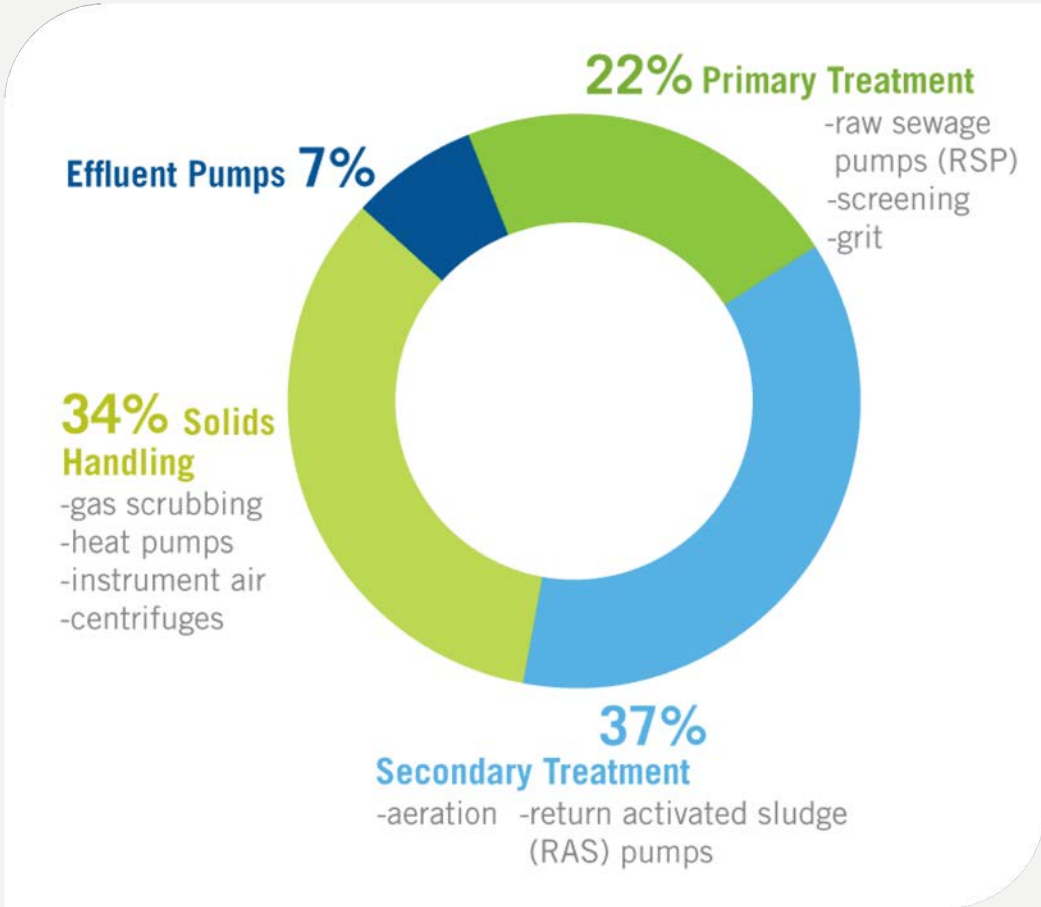


Typical Wastewater Treatment Plant (WWTP)



Consumption of Resources in WWTP

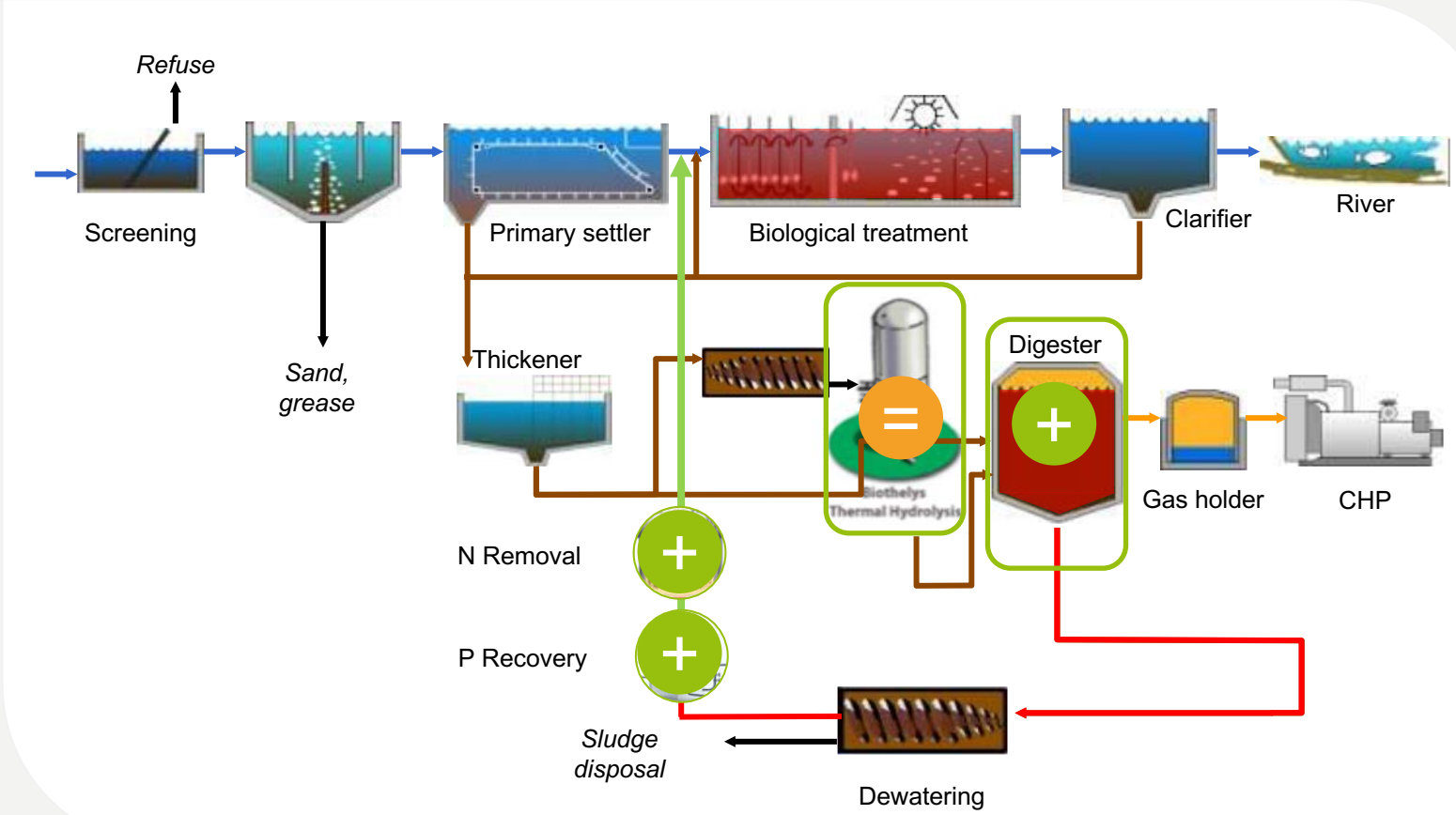
- Aeration in secondary treatment is the biggest fraction
  - *Sidestream impacts secondary treatment*
- Biosolids solution, especially AD can generate more energy than consumed
  - *Co-digestion can improve energy balance*
  - *Co-digestion also impacts sidestream*
- How to strike a balance?



Source: kingcounty.gov

Typical Water Resource Recovery Facility (WRRF)

- BNEW
- Improve or enhance digestion
  - *THP allows for increased OLR and improved AD performance*
- Recover nutrients
  - *P recovery as fertilizer*
- Reduce consumption of resources
  - *N removal using no chemicals, external carbon source*
  - *Reduce aeration needs*



Case Study - Toulouse

- Ginestous-Garonne WWTP
- Located in Northwest Toulouse
- Treats 33 MGD of wastewater

- Objectives
  - *Scalable process*
  - *Reduce final biosolids disposal quantity*
  - *Maximize biogas production*
  - *Convert to biomethane for City's gas network*
  - *Eliminate odor emissions*
  - *Security and quality visual integration of the resource recovery facility in existing neighborhood*

Case Study - Toulouse (Technologies Evaluated)

- Existing
  - *Thermal (pre) drying*
  - *Thermal Oxidation*

- Proposed
  - *High Solids Thermal Hydrolysis*
  - *Anaerobic Digesters*
  - *Deammonification*
  - *Phosphorus Recovery (optional)*

Case Study - Toulouse (Impact on Sludge Volume & SS)

- Existing
  - *Thermal (pre) drying*
  - *Thermal Oxidation*

Reduced mass; marginal impact on return cycles to head of plant (hot condenser water) −

Significant reduction of mass; considerable impact on return cycles to head of plant (scrubber, WESP) −

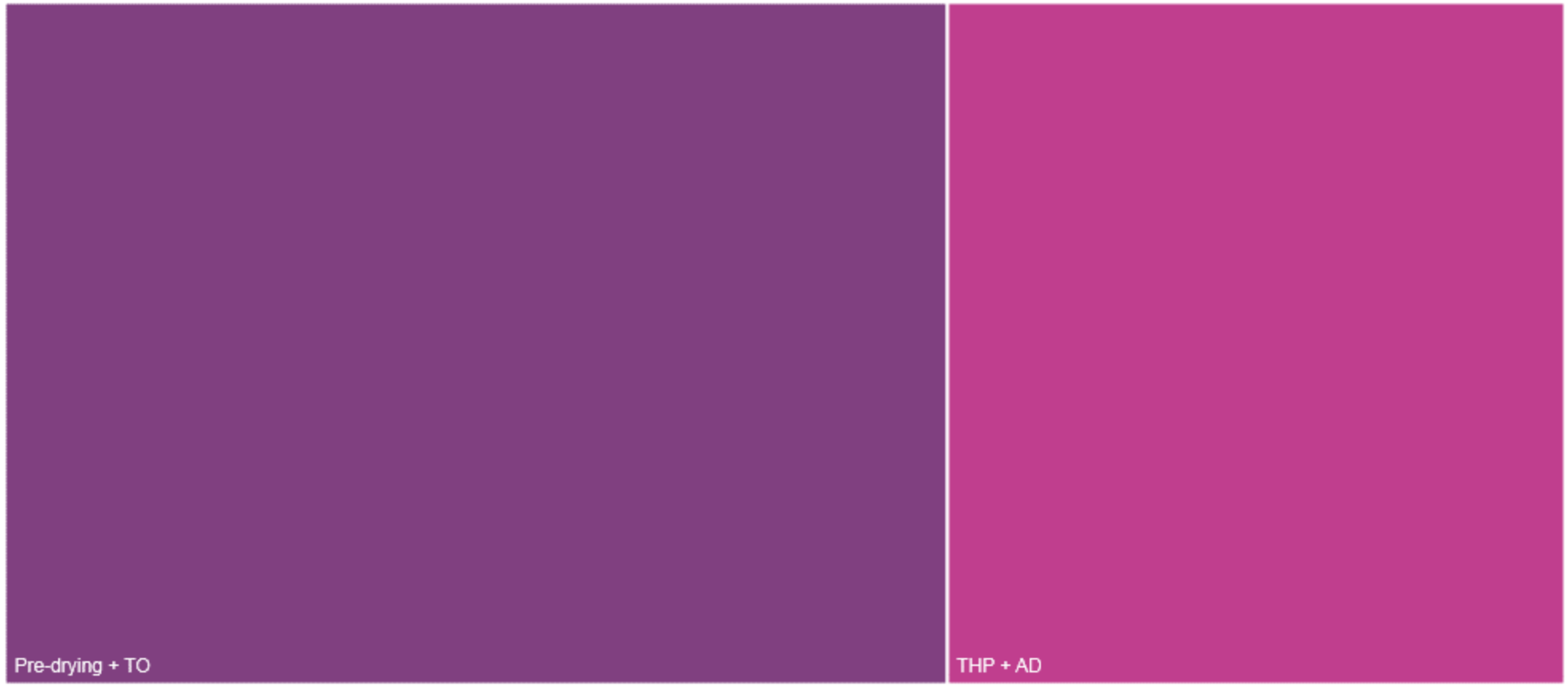
- Proposed
  - *THP + AD*
  - *Deammonification*

Reduced viscosity, reduces mass, high strength centrate with inhibitory compounds and high solids

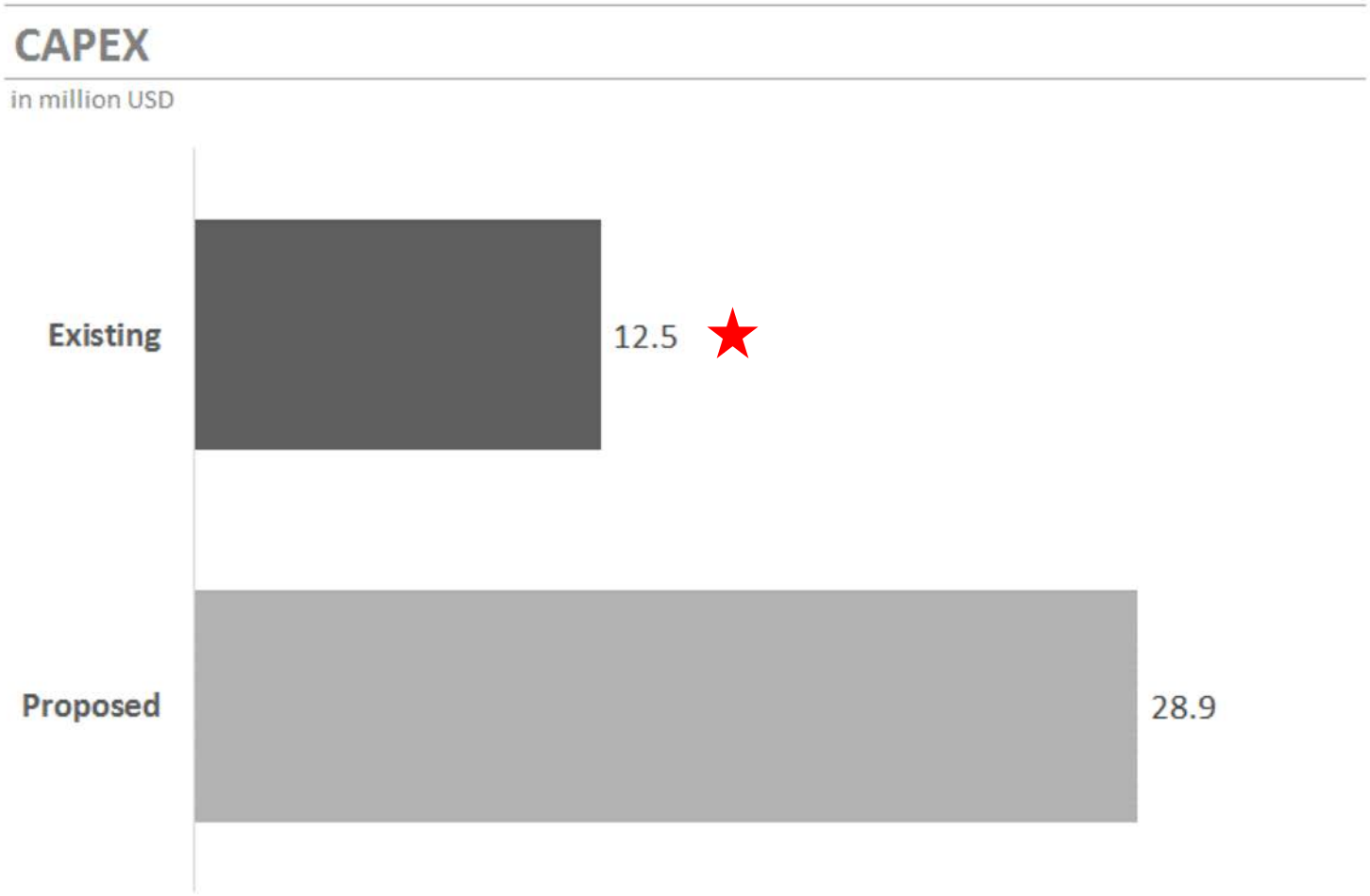
Deammonification requires dilution which increases flow +

Case Study - Toulouse (Footprint)

- Existing
- Proposed

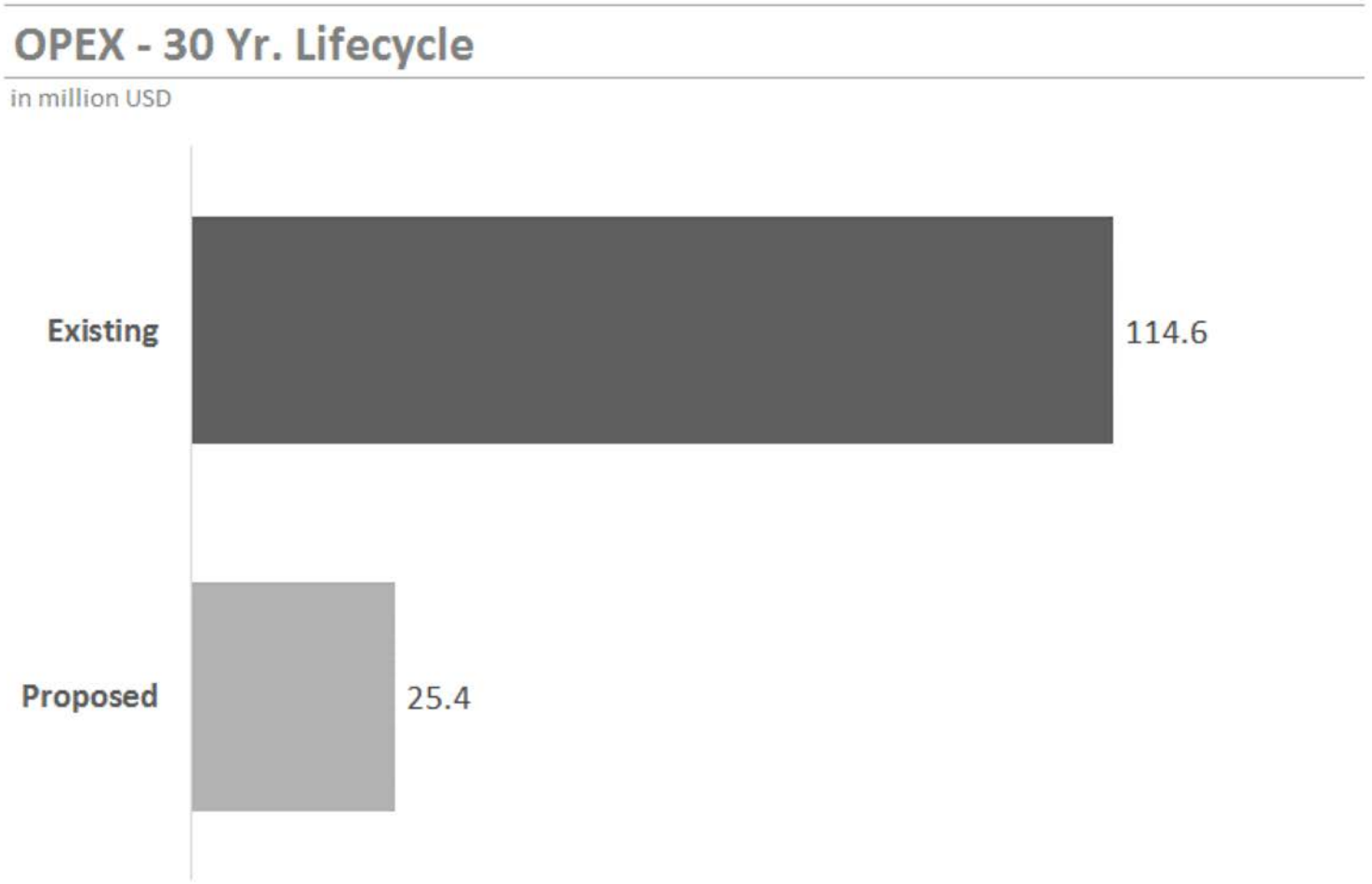


Case Study - Toulouse (CAPEX)

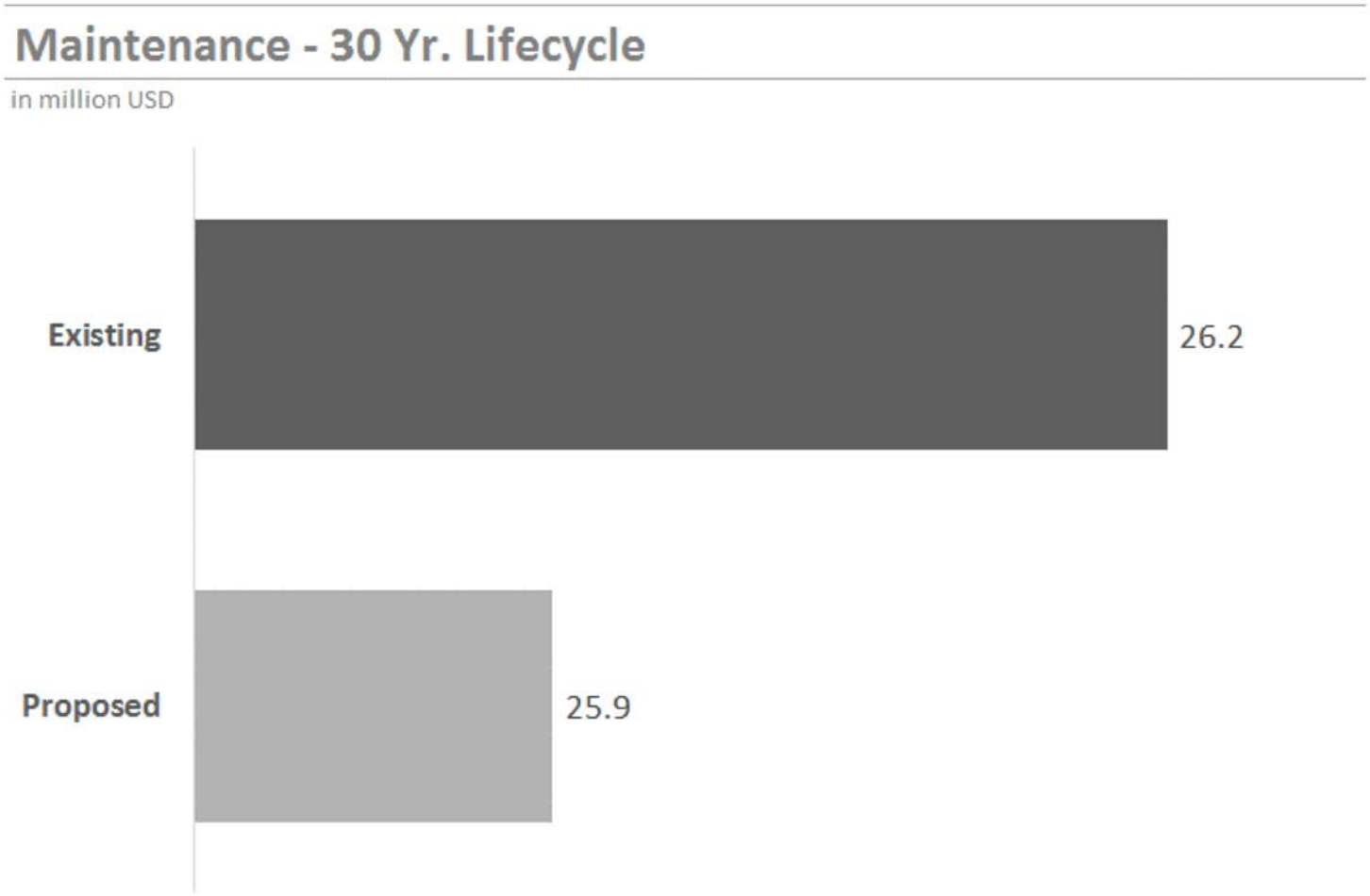


★ Repairs and retrofit to bring up to code

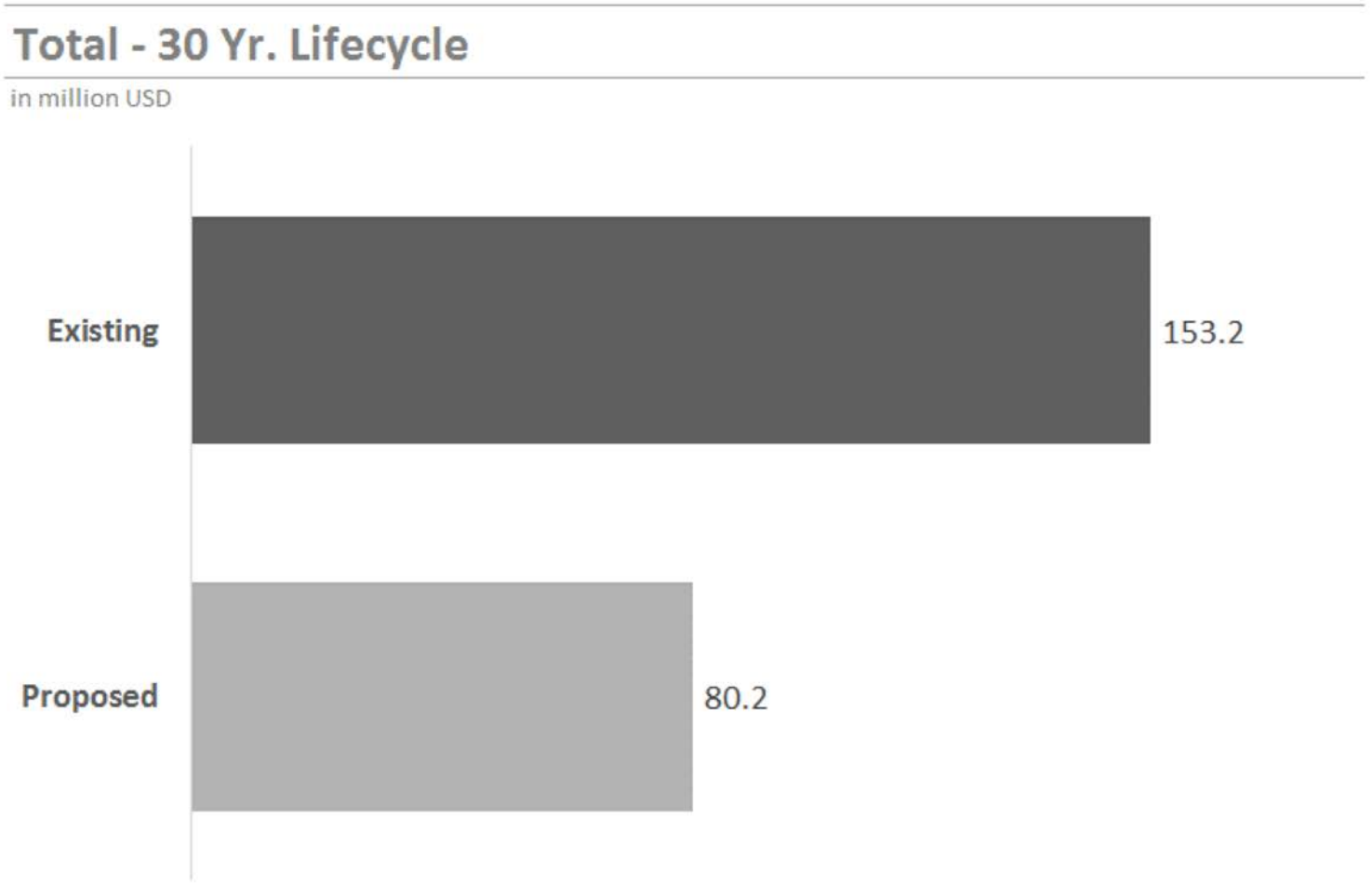
Case Study - Toulouse (OPEX - 30 year)



Case Study - Toulouse (Maintenance - 30 year)



Case Study - Toulouse (TOTEX - 30 year)



Case Study - Toulouse (Proposed System)

Case Study - Toulouse (Construction)

- BioThelys High Solids Thermal Hydrolysis
  - *Packaged batch THP unit*
  - *Model BP4*
  - *41 DTPD @ 22% DS input*

Case Study - Toulouse (Construction)

- BioMet Anaerobic Digesters
  - *High OLR*
  - *2 digesters*
  - *1.5 million gallons volume per digester*

Case Study - Toulouse (Construction)

- ANITA Mox Deammonification
  - *IFAS configuration*
  - *2 culture (fixed Anammox and suspended AOB)*
  - *400k gallon reactor*

Case Study - Toulouse (Construction)

- Struvia P Recovery
  - *Single tank crystallizer*
  - *3x AL DEC decanters*

Summary of Benefits

Ginestous-Garonne will commissioned in Spring 2020

- BioThelys High Solids THP + AD
  - *Reduces steam use by 26%*
  - *Reduces required anaerobic volumes by half*
  - *Operating at high OLR allows for reduced parasitic load from AD*
- Struvia
  - *Recovers 80% of PO4-P*
  - *Avoided cost from P recovery offers quick ROI*
- ANITA Mox
  - *Reduces aeration needs by 63%*
  - *Eliminates the need for external carbon*

VEOLIA

Thank you!

Resourcing the world VEOLIA NORTHEASTERN NEWEA WORKING FOR WATER QUALITY

Please visit: **veoliawatertech.com**

For additional information, please contact:
sudhakar.viswanathan@veolia.com

WATER TECHNOLOGIES

Thermal Hydrolysis - High Solids Batch THP

- Lysing of dewatered sludge at high temperature and pressure
  - *Lysing results in improved rheology, higher loading rates in AD*
  - *Sterilization of substrate*
  - *Increase nutrient capture*
  - *Generate biofertilizer*
- Design
  - *Medium complexity*
  - *Steam boiler operations*
- Benefits
  - *Realize net neutrality or net positive energy goals*
  - *Decrease chemical and energy use downstream*

Anaerobic Digestion - Two Phase Acid/Gas Co-digestion

- Phases separated, co-digestion
  - *Optimized for each phase*
  - *High OLR*
  - *Pasteurization at thermophilic temperature*
  - *Two step conversion, from organics to biogas, then to energy for revenue*
- Design
  - *Simple*
  - *0.1 to 0.2 lbs/ft3.d Mesophilic*
  - *Up to 0.75 lbs/ft3.d Thermophilic*
- Benefits
  - *Realize net neutrality or net positive energy goals*

Phosphorus Recovery - Rapid Crystallization

- Novel Struvite Harvesting Process
  - *Treat high strength PO4-P and NH4-N sidestreams*
  - *Single reactor*
  - *Small footprint*
  - *Affordable*
- Design
  - *Simple*
  - *< 1.5 hour CRT*
- Benefits
  - *Energy and chemical efficient*
  - *Economical*
  - *Produces valued end product*

Struvia™ Process

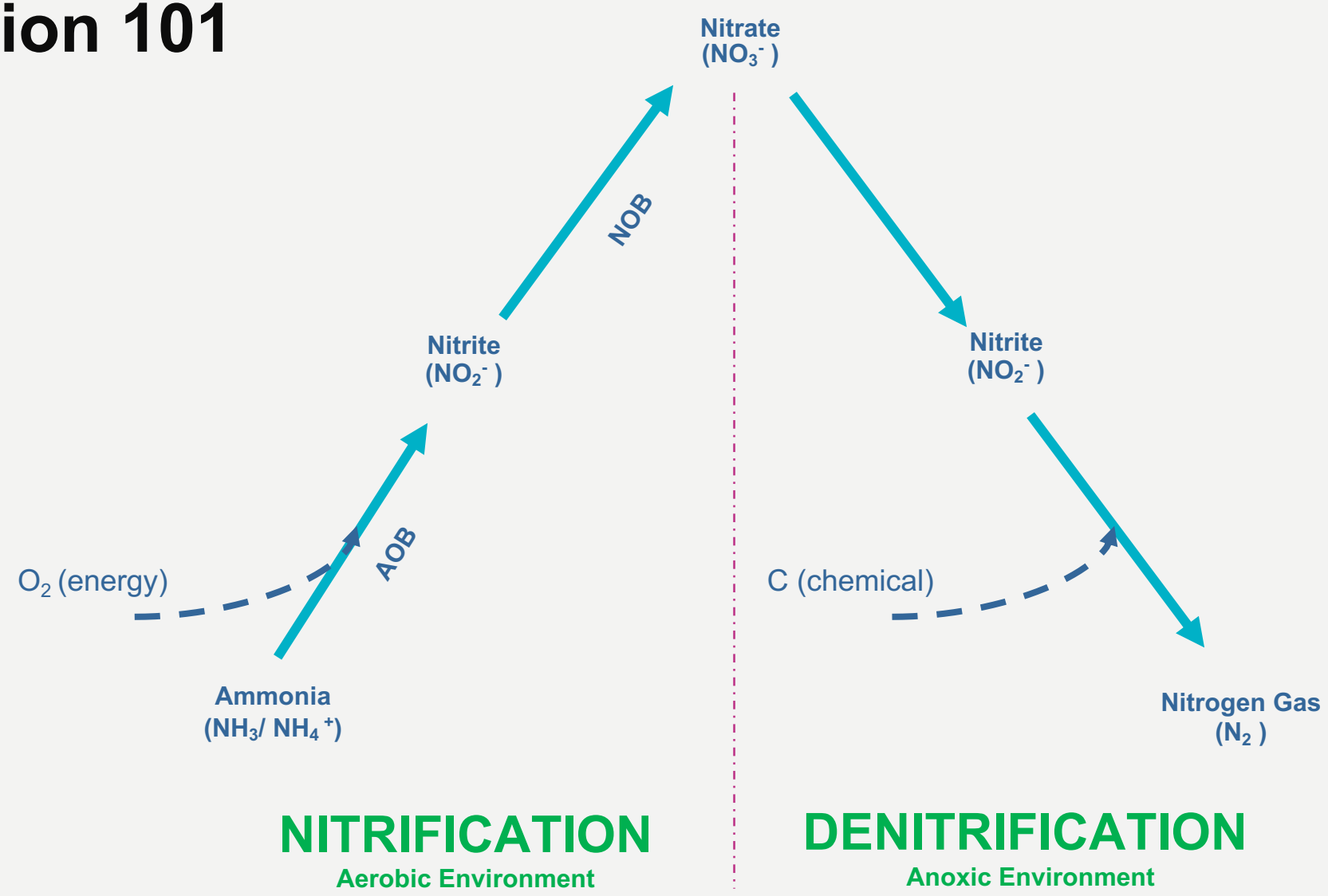
- Features
  - *Single reactor*
  - *Included chemical feed system*
  - *Patented Turbomix™ system*
  - *Integrated lamella separator**
  - *Hydrostatic purge*
  - *Included bagging system*

Deammonification - Media Supported Anammox

- Media based anammox process
  - *Robust and no impact from variable flow or TSS*
  - *Biofilm attachment ensure no loss*
  - *Biomass protection*
  - *Large surface area/volume ratio*
- Design
  - *Simple*
  - *Similar to iFAS or MBBR*
- Benefits
  - *Compact footprint*
  - *Realize energy and chemical savings*

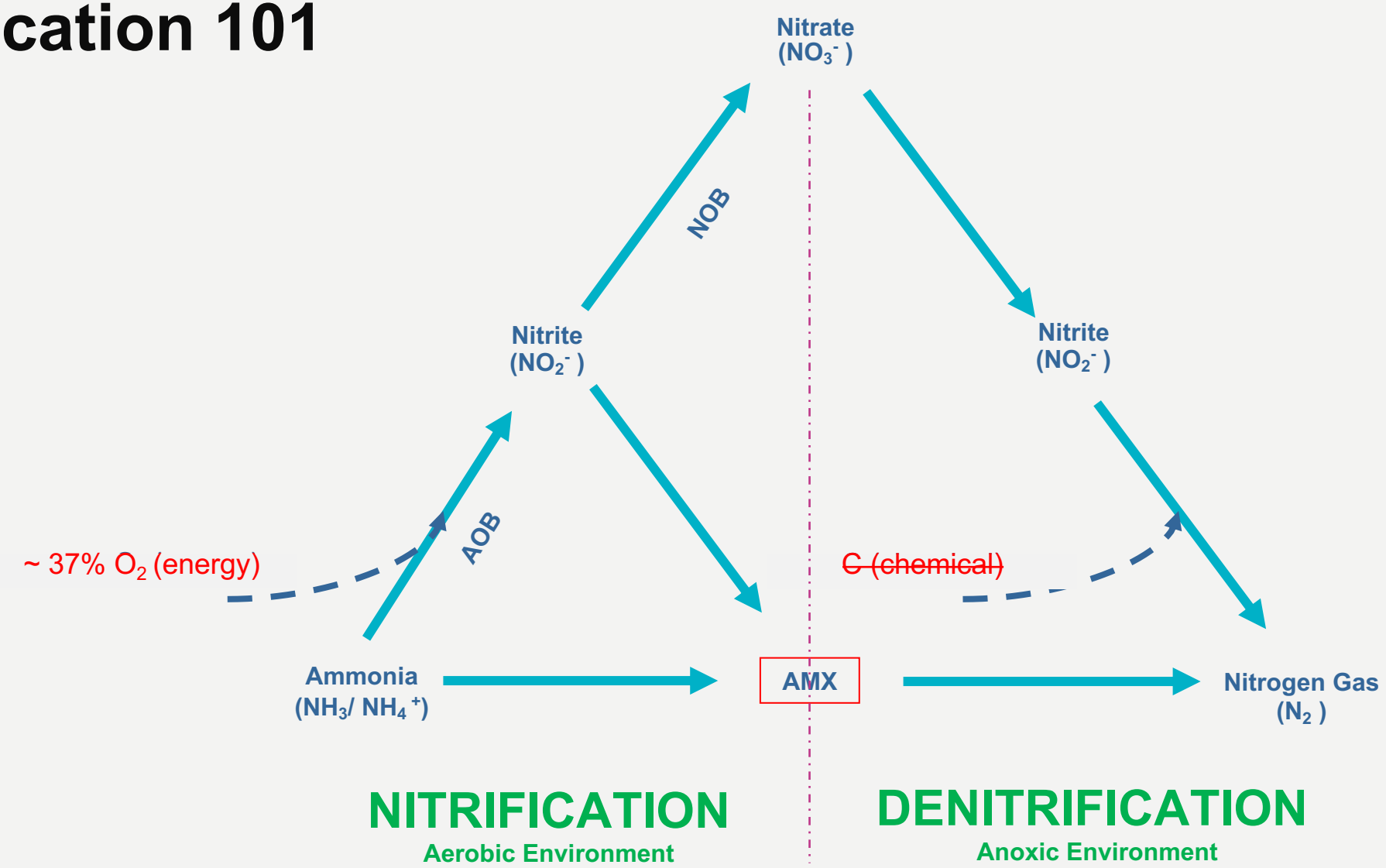
Deammonification 101

- Ammonia removal is complex, costly and undergoes numerous intermediate steps in anaerobic and aerobic environment



Deammonification 101

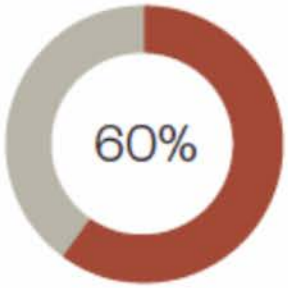
- DMX is a short cut process utilizing partial nitritation and anaerobic ammonia oxidation

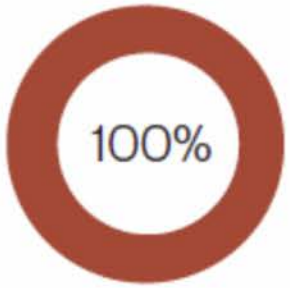


ANITA Mox vs. Conventional

Theoretical savings in three key areas when using deammonification pathway for nitrogen removal are shown below. Cost comparisons from the 2011 SDWRF Master Plan revealed sidestream treatment with ANITA™Mox to be three times lower in cost per pound of nitrogen removed when capital and operating costs were considered ($0.93/lb N removed for deammonification compared with $2.66/lb N removed for mainstream treatment).

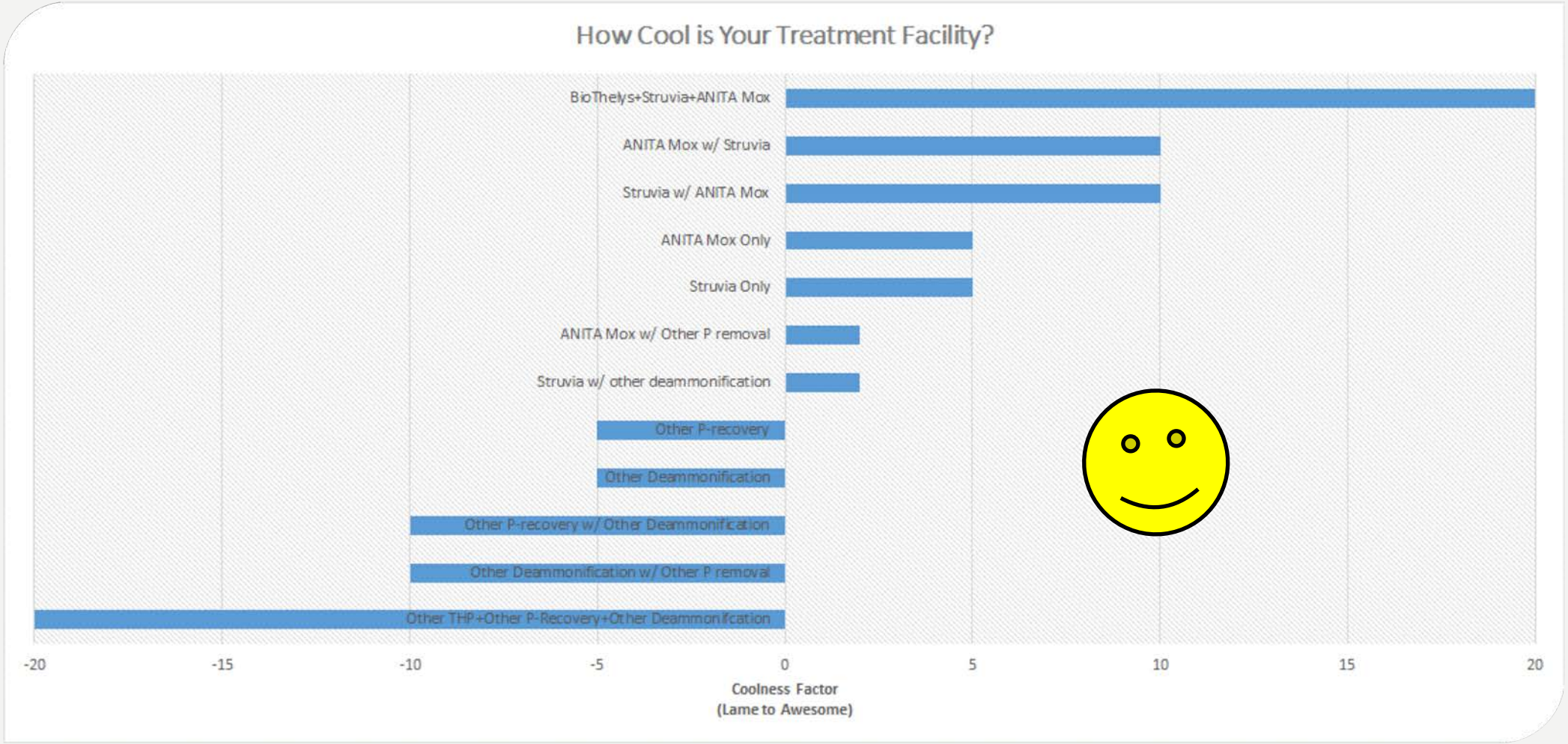
Oxygen Requirement *(lb O_2 / lb N)*	Methanol Consumption* *(lb / lb N)*	Sludge Production *(lb VSS / lb N)*
4.6 to 1.9	3.0 to 0	0.5–1.0 to 0.1





** Numbers vary for other carbon sources.*

How cool is your treatment facility?



Biosolids & Bioenergy References

- Ecrusor
  - *South Pest WWTP Phase I, Hungary*
  - *South Pest WWTP Phase II, Hungary*
  - *North Pest WWTP, Hungary*
  - *Veszprém WWTP, Hungary*
  - *Zalaegerszeg WWTP, Hungary*
  - *Gyor WWTP, Hungary*
  - *Dunaújváros WWTP, Hungary*
  - *Miskolc WWTP, Hungary*
  - *Pécs WWTP, Hungary*
  - *Nagykörös Biogas Plant, Hungary*
  - *Braunschweig, Germany*
  - *Gera, Germany*
  - *Görlitz, Germany*
  - *Prague, Czech Republic*
  - *Pilsen, Czech Republic*
  - *Hermitage, PA, USA*
- Thermal Hydrolysis (THP)
  - *Bonneuil, France*
  - *Geoje, Korea*
  - *Billund, Denmark*
  - *Yeosu, Korea*
  - *Versailles (Carré de Reunion), France*
  - *Osberstown, Ireland*
  - *Ljubljana, Slovenia*
  - *Lille (Marquette-lez-Lille),France*
  - *Hillerod, Denmark*
  - *Bonneuil, France*
  - *Toulouse Ginestous, France*
  - *Château Gontier, France*
  - *Saumur, France*
  - *Tergnier, France*
  - *Le Pertuiset, France*
  - *Monza, San Recco, Italy*
  - *Oxford, UK*
  - *Esholt, UK*
  - *Denver, CO (Pilot Scale)*
- BioCon
  - *Randers, Denmark*
  - *Roskilde, Bjermarken, Denmark*
  - *Mora, Moravatten AB,Sweden*
  - *Haapavesi, Finland*
  - *Draguignan, France*
  - *Mystic Lake (SMSC), MN,USA*
  - *Wloclawek, Poland*
  - *Buffalo, MN,USA*
  - *LeSeuer, MN,USA*
  - *Zdroje, Poland*
  - *Mullingar, Ireland*
  - *New Prague, MN,USA*
  - *Pomorzany, Poland*
  - *Evry,France*
  - *Mantes, Rosny sur Seine,France*
  - *Alderwood, WA,USA*
  - *Marquette lez Lille, France*
  - *Legnica, Poland*
  - *Western Wake, NC,USA*
  - *Versailles - Carré de Réunion, France*
  - *Lagares, Vigo, Spain*
  - *Juneau, AK, USA*
- ANITA Mox
  - *John E. Egan WRP, Chicago, IL*
  - *Robert W. Hite WWTF, Denver, CO*
  - *Viikinmäki, Finland*
  - *Bromma WWTP, Sweden*
  - *Borås WWTP, Sweden*
  - *Five Fords WWTW, UK*
  - *Oberstown WWTP, Ireland*
  - *Gryaab WWTP, Sweden*
  - *Little Patuxent WRP (Howard County), Savage, MD*
  - *Tomahawk Creek WWTF, Kansas City, KS*
  - *HRSD, James River, VA*
  - *South Durham WRF, NC*
- BioMet, Struvia, Deselec, MemGas and AquaVista
  - *Over 300 references for BioMet*
  - *Helsingør, Denmark is the first full scale use of Struvia; Aquiris, Brussels was first prototype*
  - *Over 200 AquaVista references worldwide*
  - *Over 100 MamGas references worldwide*
  - *One full scale Deselec pilot in China, one full scale Deselec pilot in France*